across the inhabitants of Agutayo, one of the Cuyos Islands. They left their home, where they could hardly get enough to bring them to Busuanga, to fish for trepang and for small prawns, which they dried in the sun, and then sold to Chinese and Indians. M. Marche was able to take measurements of a certain number of these Agutaino. He gives long and interesting ethnographical details of the Tagbannas of this island, on their marriage ceremonies, funeral rites, &c. M. Marche then went in succession to the islands of Penon, Coron, Magao-Puyao, and Dibatac. In the last he observed that the hills, which are almost disafforested by the natives, and which are about two hundred metres in height, surround fertile plains in the form of a horse-shoe, more or less closed, and in the centre a depression is observable. The whole has the appearance of a funnel, and it is suggested that this is an extinct volcanic region. In the same island of Dibatac, crocodiles and boa-constrictors are very numerous, and M. Marche was able to capture one of the latter, which had swallowed a calf several months old.

On the 2nd inst. Mr. H. M. Stanley inaugurated the newly-formed Scottish Geographical Association in the Music Hall, Edinburgh. Lord Balfour of Burleigh presided. On the 4th Mr. Stanley formally opened the rooms of the Society, and on Saturday last he opened the Dundee branch of the Scottish Geographical Society in the Kinnaird Hall.

M. Romanet de Caillaud has communicated to the Geographical Society of Paris two papers on Tonquin. One refers to routes from the delta of the Red River into Yunnan, the other on the history of the Thai or Laos race in Tonquin and Southern Kwangsi. In the former he describes in detail five routes, two by river and three by land, into South-Western China. The only one of these of importance is that by the Songkoi, or Red River, and M. de Caillaud makes light of its difficulties, and insists that Paris is practically nearer to the Yunnan frontier than either Canton or Pekin. Paris is at the most, he says, fifty days' journey, while Canton is sixty, and Hankow, on the Yang-tse, eighty days. He also advocates this route for an invasion of China, and says that Lao-kai, on the upper Songkoi, is really for France the vulnerable point of that Empire. As has been already pointed out, discussion of the Songkoi route above Hong-hoa must for the most part be based on speculation, as only one European has travelled down or up the river from or to Manhao, and his journey was undertaken in circumstances which hardly admitted of accurate observation. A German geographer has recently expressed the opinion that one of the chief difficulties to be encountered in this route will be ethnological, and M. de Caillaud, in his second paper, traces briefly the fortunes of the principal race of the region—the Laos or Thai. This people has apparently had its day. At one time it dominated the whole Indo-Chinese peninsula, but now it is split up among a number of independent or semi-independent princelets, whose main business is war and piracy. Their various attempts to recover a portion of their old power have been repressed by the Annamites, assisted, when necessary, by the Chinese.

Lieut. Bove, of the Italian Navy, has written to Dr. Hyades of Paris a letter respecting his second expedition to Terra del Fuego The first, he says, was to some extent scientific. He was ordered by the Argentine Government to study the south of Patagonia and Terra del Fuego from an economical point of view, and scientific observations were merely adjuncts. Nevertheless a scientific commission to investigate the geology, botany, zoology, and hydrography of these regions was sent with him. Lieut. Bove's official report is about to appear in Spanish in Buenos Ayres, and will be accompanied by those of the scientific men engaged. The *Bolletino* of the Italian Geographical Society will contain a paper on his journey in the interior of Terra del Fuego among the Ona. He started from Ouchonaya with an escort of twenty-four Fuegians of the mission, who proved very useful to him. After crossing the mountains behind this place, he descended into the valley which runs down to Admiralty Sound. He describes the interior of the island as magnificent, and much richer than Patagonia. The Ona were met with but twice, and their total number is estimated at from 300 to 400. The total number of Fuegians in the whole archipelago is stated, according to a careful census made by an English missionary, the Rev. Thomas Bridges, to be only 949 men, women, and children.

M. Michel Venukoff has addressed a note to the Geographical Society of Paris, referring to a new map of the island of Saghalin, prepared by M. Nikitine, the topographer. It differs from all the other maps of the island in some respects. It shows it to be considerably larger than had been previously believed. M. Reclus gives the area as 63,600 square kilometres. M. Strelbitsky 67,018, and Venukoff 73,529. Although the writer claims that his bases for calculation were necessarily more detailed and exact than those of his predecessors, he nevertheless considers his figures as approximate rather than final.

SCIENTIFIC ASPECTS AND ISSUES OF THE INTERNATIONAL HEALTH EXHIBITION[1]

[The first Wednesday lecture at the Society of Arts was devoted to an address on this subject—in accordance with precedents—the Duke of Buckingham, Chairman of the Exhibition Council, taking the chair. The following are the parts of the address relating to the scientific departments of the Exhibition, and the proposal which the lecturer is understood to have laid before the Council for some time for the disposal of the surplus to such objects.]

There was only one exhibit in the food department to which I would specially call attention, it was that from the collections of the Science and Art Department and the Parkes Museum, illustrating the constituents of food and food values, and the connected exhibit by the Society of Public Analysts, of materials used as adulterants of articles of food; of adulterated articles of food commonly sold in this country; of adulterations which have been suppressed; of adulterations practised abroad, and mixtures generally protected by labelling. This latter was added in consequence of a suggestion made by the late Mr. Wigner, President of the Society of Analysts, at a late date in the progress of the Exhibition. I am afraid that it did not attract all the attention that it deserved. I trust, however, we shall be able to reserve it for continual public reference. Mr. Wigner, in communicating with me, pointed out that, although the Exhibition was most successfully arranged so as to display in a prominent manner all the articles connected with food, yet the public were only shown what is done by the most careful and respectable firms, whose names are a sufficient guarantee that only materials of the highest quality are used in the preparation of the goods which they show.

All who are connected with food produce know how, from time to time, the desire on the part of the consumer for cheap goods is the cause of the introduction of articles called "substitutes," which are offered to the manufacturer at one-third the price of the genuine material, and which frequently consist of some cheap and simple preparation, the very opposite in its chemical character to the article for which it is said to be an efficient substitute: several cases of this kind had recently been brought to Mr. Wigner's notice. For instance, he referred to an article to be used as a substitute for tartaric acid, the composition of which has been found to be acid sulphate of alumina in solution—a substance which, if introduced into the manufacture of bread or biscuits, is as objectionable as alum, and quite as much an adulterant. Bisulphate of potash is also sold under a name similar to tartaric acid, and is equally as worthless as sulphate of alumina. These are only two instances out of many, and serve as an additional argument to show the keen competition in trade, which causes the manufacturer to produce, and unscrupulous firms to sell, such articles under "Royal Letters Patent," or some other heading of this sort, to attract the notice of the consumer.

The public analyst, Mr. Wigner added, although, of course, he should be cognisant of these facts, has quite enough work for the remuneration paid to him, and in addition to this, there is the fact that the Sale of Foods and Drugs Act is so limited in its aim and scope as to practically prevent the analyst from testing anything but the common articles of food, such as bread and milk, unless they are sold under some recognised name. Let him once travel outside these lines, and a whole host of objections are raised. What is really wanted is more stringent legislation, similar in character to that at present in operation in the United States and Paris.

In the French Section were shown the monthly reports of the Municipal Laboratory, showing the complete and thorough manner in which the food-supply of that city is protected. Why cannot something of the same sort be done in London? What is wanted is a measure defining what is and what is not adulteration, and prohibiting the use of articles which are frequently employed at the present time, and the sale of which, while benefiting one class, seriously injures another, by substituting an inferior article for one of better quality.

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[1] Extracts from an Address delivered at the Society of Arts on Wednesday, November 26, by Mr. Ernest Hart, Member of the Executive Council.

Considerable good, it may be hoped, was done by the Health Exhibition by the exhibition of these so-called substitutes. The prominent display of this instructural series in a National Exhibition has, we trust, done something towards putting a stop to a trade which, while it enriches the unscrupulous trader, places the honest manufacturer in an awkward position.

How far it has fulfilled this intention is of course not yet apparent, but I shall certainly feel it a part of my duty in another capacity, as Chairman of the Parliamentary Bills Committee of the British Medical Association, to endeavour to keep the attention of our legislators to this important subject. It may be hoped that, when the political horizon is sufficiently cleared to enable Parliament to devote some time to interests of almost as important, if less strictly party, a character as those which are now occupying their attention, that it may be possible to secure for the people of England, or at least for the people of this metropolis as an example to other great towns, some of those better securities against the adulteration of food which this country was the first to set the example of creating by legislative action, but as to which it has at the present moment fallen behind some of those countries which followed us, such as France, Belgium, and America. It is within my knowledge, and in fact within my personal experience, that in all those countries our English legislation was originally the model which they set before them. In fact, in the case of several of these countries, I have had the opportunity of receiving the gentlemen who had been sent over by their various Governments, and of furnishing them in several instances with the opportunities of study and materials of which the respective Governments have availed themselves to create model laws respecting adulteration; I would refer here especially to the German code.

It is hardly to our credit that we have allowed ourselves to be distanced in a race in which we had so considerable a start, and in which the sole goal is the public benefit, and the maintenance of the public health. These are questions largely affecting the health of the whole nation, and especially affecting the welfare of the poor, who suffer most by the substitution of worthless, inferior, or adulterated articles in the fabrication of apparently cheap, but often very dear because worthless, articles of food.

Heating, Ventilation, and Smoke Abatement.—The testing of exhibits in Classes 24 and 25—Heating and Ventilating—were carried out on a considerable scale. Some 120 kitcheners—some burning solid fuel, and some gas—were tested. A large house was rented for conducting these trials, under conditions approximating to those which would be found in the actual use of the apparatus by the public, and a large number of tests of cooking joints, &c., in the kitcheners, &c., were made. The importance and necessity of exact testing, initiated by the Smoke Abatement Committee of 1881, and since carried on in a systematic manner by the National Smoke Abatement Institution, were fully recognised by the Executive Council of the Health Exhibition. The series of testings were conducted by the acting engineer to the Smoke Abatement Institution, Mr. D. K. Clark, and the jury of the Exhibition dealing with these exhibits included Prof. W. Chandler Roberts, Mr. Robert Harris, President of the Gas Institute, and other members of the Smoke Abatement Institution whose special knowledge peculiarly fitted them for the work.

The practical advantages of such testings have been manifested in the great interest taken by exhibitors in the work, their general desire to submit their manufactures for testing, the evidently accelerated course of improvement in design since the Smoke Abatement Committee first introduced the system of tests, and the advanced knowledge derived from the results of those tests.

At the Health Exhibition these beneficial influences were clearly traceable in the adoption of good ideas embodied in apparatus shown at the Smoke Abatement Exhibition in 1881, and brought into notice by the testing treatments adopted there, as well as in the rejection of plausible but impracticable methods of heating and ventilation which found place in the earlier exhibition. The detailed report of the tests of the apparatus shown at the Health Exhibition I trust will be published, for it will form a valuable addition to a continuous and advancing series of tests. The importance of this branch of my subject can hardly be exaggerated. We can follow, in the light of the knowledge derived from the result of the later tests, a regular and most encouraging course of improvements. For example, some of the exhibits shown at the Crystal Palace Exhibition last year, in the class of gas-cooking and heating-stoves, were proved to have a greater efficiency, by about 20 per cent., than those shown at the Smoke Abatement Exhibition in 1881; while at the Health Exhibition the efficiency proved by the tests was fully 25 per cent. greater than at the original Smoke Abatement Exhibition. Besides this increased efficiency, or improvement, to be measured by lower consumption of gas for equal work done, there has been an improvement hardly less important in numerous points of detail, affecting both the durability of the apparatus, and the facility with which it can be cleaned. These latter improvements, added to the lessened price of gas, and the reduced consumption of it in the newer forms of stove, cannot fail to tend towards the increased use of these cleanly conveniences and smokeless heating appliances for domestic purposes.

The testings at the Health Exhibition brought out the merits of a number of kitcheners and stoves very well adapted for using coke and "slack," or small coal, as well as improved patterns for using the ordinary lump coal, with lessened production of smoke. In regard to the advance made in smoke prevention from domestic fires, I may mention, on the authority of the testing engineer, that the highest average smoke shade proved by the tests of 1882 was 4·18 from kitcheners; and in the test at the Health Exhibition, the highest average was only 2·4; and from open grates the average density of the smoke was 3·0 in 1882, and at the Health Exhibition it was only 1·75. The importance of facilitating, by means of improved apparatus, the use of coke and the cheaper fuels now generally wasted is obvious, and I think I may fairly claim that this section of the Exhibition achieved a highly useful and successful result. In the bakeries department no less than five distinct systems of heating bakers' ovens, practically without the production of any smoke whatever, were shown—and not only shown, but were proved by an extended course of actual working—to be more or less well suited to the requirements of the trade. Varieties of machines for making dough by cleanly and expeditious methods were successfully worked throughout the period of the Exhibition, and it is but reasonable to assume that the exhibition of these machines, shown daily in satisfactory working, must have a great future influence in putting a stop to the laborious and filthy process of making dough by manual labour.

The Library.—The library sub-committee report with great satisfaction that the library has proved an unqualified success, and that it has attracted not only a large number of readers, but a considerable proportion of serious students.

Although no purchases of books have been made, upwards of 5000 works are now included in the collection, of which over 3000 relate to health subjects. The great majority are free gifts, a small proportion are on loan. They express a strong hope that a collection of books so useful as the nucleus for the formation of a special library will not be dispersed, but that the Executive Council will devise means to maintain the library on a permanent footing, as part of a memorial of this useful and successful national undertaking.

The library was altogether a novel feature in any exhibition of the kind, and its value was attested by the considerable number of serious students who availed themselves of its extensive resources, many of them being University students, who used this unwonted opportunity in preparing for examinations. The advantages to be derived from retaining the library as a permanent institution would be great. I put before you a copy of the catalogue, made entirely by Mr. Carl Thimm. This catalogue is in itself a publication of no small interest, being the most complete catalogue of sanitary literature with which I am acquainted (although of course it cannot be said to be complete in even an approximate sense, but must only be regarded as a very valuable nucleus for a larger library), in which the hygienic literature of foreign nations, and especially their official hygienic literature, is very largely and well represented.

The Sanitary and Insanitary Houses.—Of the sanitary and insanitary houses a special handbook has been published, which will be preserved among the literature of the Exhibition, and which constitutes a small epitome of the ordinary defects of existing houses, and the simple means by which such defects may in future be avoided. I shall not enter into any description of these houses, for they are already well known to most of you, and may, I yet hope, be further studied on some future occasion. But I wish to draw your attention to the very important conferences on the sanitary arrangement of houses which were held by the Institute of British Architects in connection with this part of the Exhibition, and especially to that held in the last days of the Exhibition by the Guild of Plumbers. This I call your attention to because there is good reason to hope that out of this will spring an organisation, and I trust a legislation, which will, perhaps, do more towards the preservation of health and the saving of life than most of the much more pretentious forms of legislation which we must contemplate in the near future. The Exhibition will, in virtue of the organisation likely to follow from this conference, become the means of drawing together all those scattered forces which have for some time tended in the direction of a great improved regulation of the sanitary condition of our houses: a force, however, which, up to that moment, there seemed but little hope of being able so early and so practically to organise. I feel a peculiar interest in this subject, for I have now for several years, as Chairman of the National Health Society, and in connection with the Sanitary Section of the British Medical Association, occupied myself with collecting the facts and figures which demonstrate the urgent necessity of improved legislation for the safeguarding of the sanitary construction of our houses, and the improved education and registration of those builders and plumbers to whom we intrust that construction. I read on this occasion at the opening of the Congress a paper which I had prepared three years before, and which, in fact, I have in various forms presented to several professional and lay bodies, with the view of forming and gauging public opinion on the subject. I shall venture to put before you here now only the conclusions which I laid before this Conference, which practically and in principle received their approval, and which will thus, I hope, have an earlier chance of finding their way into the statute-book. They have the object of strengthening our statute law as to drainage and plumbing. I desire to enlist the aid of the Society of Arts in bringing into legal operation, as one result of the International Exhibition, the proposals which will be found in the Report of the Conference, of substituting sanitary for insanitary houses.

First as regards drainage itself:—

(1) Rural authorities should have the same powers as are now possessed by urban authorities. In the suburbs of towns, just outside the municipal boundaries, thousands of houses are springing up without any sanitary supervision whatever. The rural authority is, perhaps, unaware of the evil, or is, at any rate, careless about it until the houses are erected; and their opportunity of making by-laws which can control such houses is then lost.

(2) It would be well that the requirements of the Model By-Laws as to New Buildings issued by the Local Government Board should be incorporated in a Building Act which should be forthwith passed, and be of general application throughout the country.

(3) The plumbing and drainage of all buildings, public and private, should be executed in accordance with plans and specifications previously approved in writing by the local authority.

(4) No drainage-work should be allowed to be covered or concealed in any way, until it had been examined and passed by the surveyor.

(4A) The efficiency of all drains should be tested by the peppermint or some other test before they are passed; and it should be a rule that, wherever possible, drain-pipes should be kept from view only by boarding which can be readily removed.

(5) No new house should be allowed to be inhabited until it had been passed and certified by the surveyor, and a plan of the system of drainage should be appended in every case to the lease or other document for the letting of the house.

As regards the plumbers, I suggest that—

(6) The names and addresses of all plumbers should be registered by the local authority, and no plumber should be able to carry on his trade until he had been so registered, and had received a license from the local authority.

(7) Before the license is granted to him the plumber should attend personally at the office of the local authority, for examination as to his qualification as a plumber.

(8) Such licenses should be renewed from year to year, and their continuance should depend upon the good behaviour of, and the return of the work done by, the licensee.

(9) The names of all licensed plumbers should be publicly advertised once a year by the local authority.

The result of this Conference will live. Before long, I think we may promise ourselves, we shall see, as one result of this Exhibition, an active movement set on foot by which we shall henceforth be enabled to train skilled and educated workmen, and to ascertain by suitable tests their efficiency, and by which we shall be enabled to protect our artisans and ourselves from occupying houses which have been built with a total disregard or flagrant defiance of the first principles of sanitary construction, and of the conditions which we all know to be primarily essential to healthy occupation.

The Health Laboratories.—I pass to the laboratories. It did not at first, I think, appear evident to some of the members of our Council how close was the connection between the work to be carried on in these laboratories and the public health. Happily, however, that feeling soon gave way to one of acquiescence in the proposition which I made for the establishment of these laboratories, and, since, a closer examination of the subject has, I think, convinced every one that it is to establishments of research and of study, such as those over which Mr. Watson Cheyne and Prof. Corfield presided, that we must look for the most solid foundations for future progress in solving the highest problems connected with the preservation of health; and that no part of the Exhibition fulfilled a higher purpose, and to none can we look with more assured hope in the future, than to these departments of the Exhibition. A description of the laboratories appears in the official catalogue, and I shall not occupy your time with any description of them.

At the Hygienic Laboratory, in its chemical and physical departments, the public were not merely given the opportunity of seeing hygienic analyses of various kinds going on, and of having them explained to them either by Prof. Corfield or his assistants, individually or in the form of popular demonstrations—of which a considerable number were given, chiefly by the senior assistant, Mr. C. E. Cassall, during the time the Exhibition was open—but they also had the opportunity of seeing the ordinary working of such a laboratory, from the fact that Prof. Corfield was able to utilise this laboratory for his students. A class of about forty teachers, selected by the Science and Art Department from schools in all parts of the country, attended a course of lectures given by him at the Normal School of Science, and at the same time worked in batches in the hygienic laboratory at the Health Exhibition, and thus the public were enabled to form an idea of what such a laboratory is in full working order; and, indeed, during the whole time that the Exhibition was open after the above-mentioned class had dispersed, there were pupils who worked in the laboratory.

In a complete hygienic laboratory there should be a separate part set aside for physical experiments relating to hygienic appliances; but in this laboratory there was barely space for the chemical work to be carried on, and even the microscopical work could only be prosecuted to a limited extent, insomuch that the class of teachers went through their course of microscopy relating to hygiene in the physical laboratory at the Normal School, and the absence of physical appliances was replaced, as far as it could be, by demonstrations given by Prof. Corfield at the sanitary and insanitary houses.

As regards the Biological Laboratory, it is sufficient for my purpose to-night to remind you that in it Mr. Cheyne, the worthy pupil of Sir Joseph Lister, who acted as chairman of the Laboratory Sub-Committee, showed by practical working, and by collections such as had never before been seen in this country with the same completeness, the refined methods of research and of teaching by which we are enabled to study the life-history and the habits, the development and the means of arresting the development, of those minute organisms which modern science has shown to be prime factors in the causation of a great proportion of the most fatal diseases which afflict our flocks and herds, which decimate mankind, and which attack those plants and animals which constitute the staple of our food-supplies. Mr. Cheyne's demonstrations were eagerly followed by health students from all parts of the kingdom. A certain number of tables were set apart for study and research, and these were fully occupied from the first to the last days that the Exhibition was open. In Dr. Corfield's laboratory was collected the apparatus for that kind of instruction in the chemical and physical examination of soil, air, water, food, clothing, and materials of house construction, which are essential elements in the education of that great army of medical officers of health who are appointed now under existing Acts of Parliament to watch over the health interests of the community. It is very well known, however, that a large majority of those gentlemen have not this necessary instruction, and that at the present moment there does not exist in this country any adequate means for giving such instruction. There are in England 1102 medical officers of health, and 996 inspectors of nuisances, all of whom are expected to get their information and to acquire the technical knowledge of which they stand daily in need as best they can ; and it is well known that a large proportion of them are very imperfectly equipped with the necessary knowledge, and indeed can hardly be said to possess even the rudiments of systematic technical education in subjects in which they are presumed to be experts, and which they are called upon to decide in matters largely affecting the pockets of the community and intimately concerning its health. In order to illustrate the importance of the establishment in this country on a permanent footing of such laboratories as those which were shown in temporary working at the Exhibition, I shall ask leave now to refer you to an exhibit which was made in the French Court, illustrating the work done by M. Pasteur in a similar laboratory to that of which I am now advocating the permanent establishment, as the best possible sequel of this great Exhibition.

M. Pasteur is the scientific director of the École Normale supérieure in Paris, a school especially designed to supply professors in literature and science to the *lycées* or higher schools of France. He is not, however, called upon to undertake teaching, but is expected to devote all his time to his researches. In a word, in consideration of the considerable national services which he has rendered, an exceptional position has been accorded to him. He receives a professorial salary of 400*l.* a year. M. Pasteur is also the head of l'École des Hautes Études, of which Mr. Chamberlain is the sub-director. In this laboratory he receives some pupils. He possesses further a laboratory at the École Normale, where M. Roux is his coadjutor, and where are admitted some students who are generally persons already known for their studies. He has entire freedom of the choice of students of the laboratory of l'École des Hautes Études, as well as those of persons who work in his private laboratory at the École Normale. About 800*l.* a year are allowed for this laboratory by the Minister of Public Instruction, and for the last few years, 30,000 francs from the Minister of Commerce and Agriculture. These grants are renewed yearly.

The principal researches of M. Pasteur have related to—

(1) *Wine*, in which he demonstrated that, in order to avoid the transformation of alcohol into acid, it is necessary to destroy the germs remaining in wines which are poor in alcohol, by heating them up to 55°-60° Centigrade. He has also studied the action of oxygen and light on wine, and has demonstrated that it is to this action, *i.e.* to the oxidation of the materials of wine, that we are to attribute the development of the bouquet of wine, *i.e.* the flavour which it acquires with age. In order that this may yield a product appreciated by amateurs, it is necessary that it should proceed slowly. He has further demonstrated that the ferment of wine exists on the surface of the grape when it has ripened. He has demonstrated the useful and precise indications which the areometer furnishes, in order to appreciate during fermentation the state of the *mout* of the grape.

(2) *Beer.*—After having demonstrated that brewers employ, generally, a ferment containing, among others, injurious germs, M. Pasteur indicates the following means for obtaining a pure ferment. A small quantity of pure yeast is prepared according to the exact rules of the laboratory. This is introduced into a large copper pan, three-quarters filled with the wort of beer, which has been first carried to the boiling-point, and then cooled before the introduction of the yeast. The vessel only communicates with the external air by a long tube of copper, many times bent, in such a way as to permit the gases to escape without external germs being able to enter. When the wort has been developed, it is drawn off by a tap placed in the lower part of the apparatus, and which is previously purified with the flame of a spirit lamp. The wort of the beer is put to ferment in a large white-metal vat, resting on a plank, and closed by a movable cover, this movable lid dropping into a groove which is kept full of water. As the wort arrives in a boiling state in this vessel, it destroys any germs which may exist there. When it is cooled, and the cooling may be rapidly aided by the use of external cooling water, the yeast is introduced through an opening in the lid. The aëration of the fluid is obtained by two tubes curved downwards, by one of which carbonic acid escapes, and by the other the air enters after being previously filtered through a layer of cotton wool rolled round a cylindrical cage on metal wires which cap the extremity by which the air enters. This apparatus, like the foregoing one, reproduces exactly the conditions which are found to be necessary in the laboratory to prevent the introduction of external germs. The aëration by these two tubes is sufficient, for the carbonic oxide being heavier than air, they are placed in such a way as to form a siphon ; moreover, during the fermentation, the wort is certainly kept in movement by the ebullition of the gas which escapes, so that the aëration, although less active than in some of the technical apparatus previously in use by brewers, is more than sufficient. By employing this procedure, secondary fermentations are no longer to be feared, and the spoiling of beer by secondary fermentation is almost entirely put an end to.

(3) A third and profoundly interesting series of researches, which have had a great influence on agriculture, carried on by M. Pasteur, are those relating to *charbon*—the malignant pustule or black quarter of cattle and sheep. M. Pasteur has demonstrated that animals of the ovine and bovine species may be prevented from contracting the disease of *charbon* by inoculating them with attenuated germs, obtained by artificial cultivation of the specific minute organism which is ascertained to exist in the case of *charbon*, and to be the efficient cause of the disease. This attenuated preventive material for inoculation is obtained by the aid of what are known as cultivations of the germs made in special liquids. After the first inoculation with the highly attenuated virus, Pasteur has shown that the second inoculation may be made with a product of medium virulence, and that the animals thus twice vaccinated were unsusceptible of contracting the disease. Pasteur has further demonstrated that the bacterium of *charbon* is capable of retaining its vitality for several years in the earth, and that, when brought to the surface by earth-worms, it is capable of infecting the animals which eat the grass polluted by its contact, especially if the grasses or plants so eaten be hard, and such as to cause abrasions in the mouth and digestive tube.

(4) *Silkworm Disease.*—M. Pasteur, after having assured himself that normally, and in good health, silkworms never contain, at any moment of their life, the bacteria or corpuscles seen for the first time by Guérin Menneville, demonstrated that the eggs of the worms, even when only slightly attacked, contained a great number of these corpuscles or bacteria, which developed in considerable quantities when the animal underwent its metamorphoses, and finally destroyed it. Since its droppings polluted the leaves of the mulberry on which the silkworm feeds, and as healthy animals thus devoured them, and contracted the same disease, a single infected silkworm was capable of destroying a whole school of worms, and preventing the subsequent cultures from being developed.

M. Pasteur then laid down the rule that, in order to avoid the silkworm disease, it was necessary to choose with extreme care the animals which were to be employed for breeding. With this view he devised the following procedure :—When the female has laid its eggs it is at once destroyed. If a single corpuscle is found in its tissues, when crushed in water, the eggs are immediately burned. In the same way the several eggs of each hatching are carefully examined. If no corpuscles are discovered, the whole brood is preserved for culture ; if any are found, the whole are immediately destroyed. Since that time the silkworm breeders have followed the rules of M. Pasteur. The implements for the purpose of recognising the diseased worms consist of a microscope, two objectives, one with low power, and one with high power, magnifying about 400 times, and a small porcelain mortar for crushing the tissues of the worm or its eggs, some glass slides, and a flask of distilled water. By this application of scientific research to the silkworm industry the silkworm disease has been almost wholly put an end to. Nearly all the silkworm growers, whether masters or servants, have learnt, by the aid of a very cheap little handbook, prepared by M. Pasteur, to recognise diseased worms or eggs from healthy eggs or worms, and thus a great industry, which was threatened with extinction, has been saved from the fate which threatened it.

(5) *Fowl Cholera.*—After having demonstrated that this affection is caused by a micrococcus, M. Pasteur showed that if this micrococcus is cultivated in the manner which he indicates, and the micro-organism thus obtained inoculated in a fowl, the fowls so vaccinated become proof against fowl cholera, even when they are placed in the midst of other infected fowls. These researches have a special and suggestive scientific interest, for he has shown that if you filter through plaster the liquid taken from one of the external foci of the disease in a fowl affected with fowl cholera, the filtered liquid thus inoculated will not give a healthy fowl the specific disease, but render it somnolent

and inert for some hours, so that it may be concluded that the micro-organism secretes a material to which must be attributed the lesions which are observed in fowls suffering from fowl cholera.

Some idea may be obtained of the commercial value of the work done by M. Pasteur in his laboratories from the following facts and figures, which I have on good authority:—In three departments of the centre of France, after the silkworm disease had attacked the factories, the product yielded a value of less than 1,500,000 francs. Since the regulations laid down by Pasteur have been applied, the average value per annum, calculated on five years, in those departments has risen to more than 22,000,000 francs.

As to wine, there was a known loss of wine to the extent of 1,700,000 francs in four departments. Since heating on Pasteur's method has been applied, there has been saved of this loss at least 1,500,000 francs; the difference of 200,000 francs being alleged to be due to the carelessness or ignorance of small proprietors, who are unwilling to heat their wine. As there are in France about forty-five departments that make wine, the saving may thus approximately be estimated. I should add that there are twelve departments that make silk.

In respect to anthrax, the following was the official statement indicating the ravages made by this disease in France and foreign countries, and the reduction of mortality effected by these inoculations:—

	Sheep	Oxen	Horses
1881			
France	62,050	5977	142
Foreign countries	12,500	1254	100
Total	74,550	7231	242
1882			
France	270,040	35,654	1825
Foreign countries	36,830	6,169	200
Total	306,870	41,823	2025
1883			
France	268,205	26,453	371
Other countries	84,825	5,777	975
Total	353,330	32,230	1346

The average mortality reduced by these inoculations in the proportion of 10 to 1 for sheep, and 15 to 1 for oxen, cows, and horses.[1]

Meteorological Laboratory.—The corresponding exhibit was that of the meteorological laboratory by M. Miquel, corresponding to which I hope to see a permanent meteorological station established as a sequel to the Exhibition. The work of M. Miquel has been summarised in the following words by Dr. Vivian Poore:—The observatory for Montsouris was established, in 1871, by the influence of M. Dumas, who was then President of the Municipal Council of the city of Paris. In 1873, M. Marié Davy was appointed director of the observatory by M. Thiers. The work of the observatory is as follows:—

(1) Meteorology proper, and its application to agriculture and hygiene. This department is under the control of M. Léon Descroix.

(2) Chemical analysis of the air and rain, under the control of M. Albert Lévy.

(3) The microscopic study of the organic matters held in suspension in the air and rain. This is under the control of M. P. Miquel.

In 1876, the municipality decided to have the above meteorological observations, in their relation to hygiene, made in different parts of the city. The chemical analyses and microscopical examinations are made—

(1) On drinking waters.

(2) On the waters infiltrating the soil.

(3) On the emanations from the soil and sewers.

(4) On the air of different localities estimations are made. A. (air), ozone, carbonic acid, ammonia, organic nitrogen; and similar analyses are made of the soil-water, &c. Every year the *Annuaire de Montsouris* is published, a work full of information, and which is now in its thirteenth volume.

The laboratory of Mr. Cheyne at the International Health Exhibition was largely fitted up by the aid of Dr. Koch, and of Dr. Koch's laboratory at Berlin. Mr. Cheyne has furnished me with the following outline:—

Dr. Koch's laboratory is subsidised by the Government. It consists of director, library, biological department under Dr. Koch and several assistants, and a chemical department. All expenses of investigation are paid. Koch's salary is only 300*l.* Other salaries I do not know. When appointed, Koch first set to work to improve methods of cultivating and studying bacteria, and to devise new methods, and the result has been a precision and simplicity in this sort of work quite beyond all expectation. His further researches have been devoted to the study of the cause of disease in man and how to prevent it. Either by himself, or under his direction, the causes and means of prevention of tuberculosis, consumption, erysipelas, osteomyelitis, and glanders have been absolutely demonstrated, while a large amount of work has been done in respect to the causation and prevention of typhoid fever, cholera, diphtheria, and other affections. His researches on disinfectants and the best mode of disinfection are classical, and are still being carried on. This work is being rapidly extended to other diseases, while important researches are going on relating to water, air, and soil.

The Anthropometric Laboratory at the Health Exhibition was designed by Mr. Galton, to show the feasibility of performing, at a small cost, an extended series of measurements of the human faculties, and of testing the demand that there might at present be for having such measurements made. The ulterior object he had in view was to familiarise the public with the facility and need of periodically recording facts which test the progress of individual growth and development, whether it is proceeding normally or otherwise; and if it should be abnormal, to call attention to the existence of hurtful influences, and to demand inquiry into their nature, and whether they may not be removable. The experience of the laboratory showed emphatically, first, that about seventeen different measurements of each person, including height, weight, strength, breathing capacity, eyesight, judgment of eye, hearing powers, &c., could be accurately performed at a cost of less than 3*l.*, by means of a well-organised method of work; secondly, it showed that the public greatly valued the opportunity of having themselves measured and appraised in so minute a manner, inasmuch as the door of the laboratory was besieged all day long by a crowd of applicants for admission, far more numerous than could be accommodated in its small area, 36 feet long by 6 feet wide. As it was, measurements were made of between nine and ten thousand persons, yielding data that are now being discussed, and which have considerable statistical value. The methods and appliances used and suggested by the experience of this laboratory have been very recently described by Mr. Galton at the Anthropological Institute. It is therefore not necessary here to go into details. It may be taken as established that there need not be the slightest difficulty in periodically measuring with much completeness and keeping a register of the development of every boy and girl in large schools, at the cost of a very few pence per head per annum, on the supposition that the process was methodically conducted by a paid expert, with the willing and gratuitous assistance of the masters and attendants. The power of a system of periodical measurements and tabulated returns upon the well- or ill-being of the growing portion of our race is of unquestionable value, and it would seem that common-sense considerations must insure its being ultimately called into action. Now that there are signs of much awakening to the importance of such records, a central institution becomes especially desirable, where the best patterns of instruments should be kept, where instruction in their use might be obtained, where the methods of tabulation, and of quickly getting useful results out of the data, might be learnt, and where the fullest information of all kinds on anthropometry would be stored. It must not for a moment be supposed that anthropometry is a simple and thoroughly understood art. On the contrary, it continually grows, new methods being discovered from time to time of measuring faculties that had before escaped measurement. There can be little doubt that the progress of the useful art of knowing one's self all round, and of knowing others accurately, of reducing what has hitherto been too much a matter of estimate to quantitative measurement, would be very largely aided by the establishment of an anthropometric laboratory in a national hygienic institution.

Proposed Disposal of Surplus.—That which I look forward to, then, as the best possible sequel to this Exhibition, is the establishment of these laboratories, so vastly important to the prevention of disease and the maintenance of our population in health, and of the library on a permanent footing and under suitable direction. The whole subject is one on which I can only venture to express, thus far, my individual opinion, although I have the satisfaction of knowing that the views which I have thus put forward have met with considerable approval among many of my colleagues, to whom I have submitted them *in limine* for future consideration by the Executive Council, who may possibly approve of them, and in that case may feel it their duty to submit them to his Royal Highness the President, with whom will rest the ultimate decision as to the disposal of any parts of the surplus. The rumour that such a project was about to be submitted to the Council, has awakened the liveliest interest and satisfaction amongst the authorities of the leading sanitary associations in this country, and I am glad to know that the authorities of the Parkes Museum, of the Sanitary Institute, of the Social Science Association, of the Society of Medical Officers of Health, and of the National Health Society, have each, on their own individual motion, taken the opportunity of expressing, by resolutions and memorials, their strong sense of the great national value which they consider would attach to the accomplishment of this design. Should this proposition prove acceptable to the authorities, there is no doubt that the opinion of the great body of persons interested in the sanitary progress of this country, thus early expressed by the official representatives of every form of sanitary progress, would declare itself strongly in favour of an institution from which considerable results might be anticipated in the furtherance of health education, and of our knowledge of all that relates to the prevention of disease. It is further hoped that an Institute of Public Health, founded on this basis, might prove a home and centre with which these numerous voluntary organisations now working for the public health might connect themselves, by some well co-ordinated and accepted plan; that it might be a centre where their members would be able to meet; where libraries, class-rooms, and meeting-rooms might be made to serve a valuable purpose in bringing these various societies into closer relation. There is reason to hope that many of the great scientific associations which now foster the progress of science by grants to individual workers, would heartily welcome the establishment in this country of what it so greatly stands in need—a place of higher education and research in sanitary science, such, as I have already pointed out, as have been recently created in France and Germany. England has been first in sanitation; it is here that have been solved—so far as they have as yet been solved—many of the greatest problems of sanitary science; but we must acknowledge that, during the last decade, each of these countries has made progress in the higher departments of sanitary education and sanitary research, in which we can hardly be said to have held an equal place. This reproach we may now find the means of wiping away, and I earnestly trust that this may prove to be a sequel of the International Health Exhibition, than which no higher memorial could have been hoped for or expected.

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[1] In the last thirty years there has been an increase of life-duration of from 39·9 to 41·9 years, an increase of 5 per cent. human duration of life. The annual economy of life, on the least favourable calculation, during the last five years, has been equal to a saving of 36,000 lives per annum. The money saving on the last five years has been calculated, on good basis, by Capt. Galton, to be in London alone nearly half a million of money per annum.

The Lesson of the Exhibition as to Open-air Recreation and the Electric Lighting of Public Parks.—Let me conclude by reference to another aspect of the teaching of the Exhibition, less scientific, but yet of peculiar public importance. It was often said by the public scorner—a person from whose judgments and criticisms we have commonly much to learn—when walking through the crowded course of the Exhibition devoted to food and all that concerns the construction and decoration of the dwelling: "This is a Health Exhibition—where is the health?" and the popular answer was, "Outside in the gardens." That answer also I accept. I think you will agree with me that the practical demonstration which this Exhibition afforded of the eagerness of the English people to resort to healthful means of outdoor amusement was in itself a valuable result and an important experience. The gardens, illuminated by the electric light and enlivened by music, were undoubtedly a great attraction to the Exhibition, and I would be quite willing to agree with any one who might say that they were the greatest attraction. Allow me to add that I look upon this not merely as a means, but itself an end. It is no small thing to have acquired the conviction that our open spaces may be, and should be, much more largely devoted to the open-air recreation of the people than they are at the present moment. I say this now, without any intention of entering upon that large question, but with the specific desire to repeat (for it is only by repeating often that one can gain access to the minds of the majority who are all-powerful in such questions) that it appears to me to be no small disgrace to this great metropolis that, in the very centre of its crowded districts, within an arrow's flight of the houses probably of most of us who are here, there lie great open spaces, such as Hyde Park (but what I say refers also to Victoria Park), which at night are dreary desolate areas of darkness, which are unlighted, which are dangerous to cross, which are unused in the evenings for any wholesome or moral purpose, which are often scenes for the display of some of the worst vices incidental to the lowest dregs of the population of the great city. Why should we not learn from the success of the music and the lighting of the gardens of the Health Exhibition, that our great parks should all be lighted by the electric light at night, and that throughout the spring and summer months the military bands should play there, and should make those places, which are now not only useless but scandals to the metropolis, the sites of healthful and innocent recreation? I have inquired from a good source what would be the cost of lighting Hyde Park by the electric light; and I am not speaking without data when I say that I believe that Hyde Park could be adequately lighted with the electric light, so that it might add to the resources of health and enjoyment for the teeming population surrounding it, at an annual expenditure of about 5000*l.* I do not know what impression this will make upon you. I confess that to me such an expenditure seems trifling in consideration of the sum of human happiness and enjoyment, and, I may add, also of health, which such a devotion of municipal or public money would afford to the people of this city. Nor is it likely that, the example once set, it would end here. Our eastern population have a right to the enjoyment of their parks in the evenings that could be conceded to the west. This lesson also, then, the Exhibition seems to me to teach, and how greatly we might all rejoice *if it* should ultimately prove that the lighting by electric light of our public parks, and the introduction of music as a part to enliven and attract the people, and to add to the success of the innocent recreation, the health and the happiness of our working population should form also one of the possible sequels of this Exhibition.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—Prof. Roy was on Thursday last admitted to the degree of M.A. *honoris causâ.* The Public Orator in presenting him spoke as follows:—

Dignissime Domine, domine Procancellarie, et tota Academia, —Quis nescit Athenas illas Caledonicas, cum aliarum artium, tum praesertim studiorum medicorum praeclaram esse sedem. Academiae tam illustris alumnum, Pathologiae Professorem primum nobis nuperrime datum, hodie senatus totius nomine salutamus, ipsum senatorum nostrorum ordini libenter adiungimus. Neque vero una tantum doctrinae sedes Professorem nostrum sibi vindicat; scilicet Germaniae ipsius Academiae celeberrimae hunc virum inter alumnos suos numerant. Ne inter Cantabrigienses quidem prorsus hospes est, qui non modo Physiologiae praeceptoris nostri optimi experimentis aliquamdiu interfuerit, sed etiam ipse de Physiologiae arcanis praelectiones quasdam inter nosmetipsos habuerit. Idem quondam (ut ad remotiora transeamus) Ottomannorum inter milites arti medicae deditus, in ipsa Epiro, prope Pindi montes, prope Dodonae antiquae diu desertum oraculum, velut ἰατρόμαντις aliqui, consulentibus respondebat. Ad eundem postea Respublica Argentina, morbo gravi et inexplicabili oppressa, velut ad oraculum aliquod misit, cuius responsis obsecuta peste illa dira sese protinus liberavit. Inter antiquos quidem victimarum in visceribus rerum futurarum praesagia quaerebantur; hic autem, non vanus haruspex, ex ipsis morbis quos alii reformidant, ex ipsa Morte quae aliis tacet, veritatem ipsam audacter extorquet,—adeo ut Catonis verbis profiteri possit:

> *me non oracula certum*
> *sed mors certa facit.*[1]

Vobis praesento Medicinae Doctorem Edinensem, Pathologiae Professorem Cantabrigiensem, CAROLUM SMART ROY.

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[1] Lucan, "Pharsalia," ix. 582.